EC ECOLOGY AND ENVIRONMENTAL SCIENCE
Editorial

# Engineered Nanomaterials in the Food-Energy-Water Nexus: The Next Quantum Leap or Global Threat?

**Erick R Bandala***

*Division of Hydrologic Sciences, Desert Research Institute, Las Vegas, Nevada, USA*

***Corresponding Author**: Erick R Bandala, Division of Hydrologic Sciences, Desert Research Institute, Las Vegas, Nevada, USA.

**Received:** September 28, 2018

Sustainable production of food, as well as securing energy and water supply for an increasing population is a significant global concern. To further alleviate hunger and poverty, sustainable food production needs to be increased while taking care of resources such as water, energy, nutrients and land. The interdependence of population growth, food shortage, water scarcity, and the lack of energy resources significantly affects sustainable development as conceptualized by the Sustainable Development Goals proposed by the United Nations. Assessing the benefits and risks of new technologies prior to being applied to human activities is a priority task to avoid adverse effects on human health and the environment. The use of engineered nanomaterials (ENMs) have emerged in the last two decades as a technology capable to reaching and improve all human activities including applications in water treatment [1], energy production [2] and food production intensification [3]. The absorption, translocation, accumulation and biotransformation of ENMs once released into the environment, however, remains mostly unknown and its benefits and/or harmful effects remains as pending topic [4]. To evaluate when a specific ENM represents a risk, physical and chemical characterization is needed along with an accurate understanding of its biological activity. Several reports exist related with the negative impacts of ENMs to plants; soil or aquatic organisms [5] and, at the same time, on the positive achievement of its use for a wide variety of improvements [6]. As result, a scientific gap clearly exist in assessing the behavior, effects and ENMs properties that deserves attention. For example, limited information exist about the amount of ENMs used or accidental exposure of food and food-related products to ENMs.

Addressing ENM toxicology is a complex task because the wide variety of core types, surface chemistry, and electronic properties shown by ENMs. All these properties affect ENMs reactivity and biological interactions depending on their uses, disposal, transport and bioavailability [7]. Proper characterization of ENMs toxic responses from plants, microorganisms and animals, however, is of major interest, considering the lack of quantitative techniques to monitor its emission, and concentration in the environment [8]. As the trend for in purpose usage of ENMs in the food-energy-water (FEW) nexus increases by the promise of improvement in current practices [9], the need of analysis on the real advantages and threats generated by these products should be the highest priority [10].

We have learned that lacking of knowledge on the consequences of man-made products led to significantly regrettable results and we still are struggling with the aftermath of, for example, the use (and abuse) of agrochemicals (synthetic fertilizers, chlorinated pesticides). The benefits related for the use of nanotechnology in the FEW nexus are tempting, just as chlorinated pesticides were at some moment around mid-twentieth Century. There is a growing body of studies on the toxicity of ENMs to soil bacteria and their impact on other environmentally significant processes and properties, however in many of the cases the reports are not conclusive or even contradictory [5]. Nanotechnology has been reported capable of producing the expected outcomes in increasing productivity to meet the challenges in FEW security [9], however its massive use is expected to face constrains related with regulations, and intellectual properties rights, among several others. Ethical implications and public acceptation of use of ENMs in the farmland and/or food production, for example, is a significant limitation. Some ethic principles have been proposed suggesting systematic ways to enhance nanotechnology advantages and minimizing risks, regrettably multiple toxicological studies lacking of scientific rigor have generated questionable results that demerit the current efforts and bias the public opinion. It is worth noting than us, the scientific community, have to embrace the ethical duty of doing pragmatic research and scrupulously report our findings. History will judge whether we are in the preface of the next quantum leap in the FEW nexus or just in the starting point of another global threat.

## Bibliography


1. Rodriguez-Narvaez OM., *et al*. "Treatment technologies for emerging contaminants in water: A review". *Chemical Engineering Journal* 323 (2017): 361-380.

2. Scanlon BR., *et al*. "The food-energy-water nexus: Transforming science for society". *Water Resources Research* 53.5 (2017): 3550-3556.

3. Liu R and Lal R. "Potentials of engineered nanoparticles as fertilizers for increasing agronomic productions". *Science of the Total Environment* 514 (2015): 131-139.

4. Gardea-Torresdey JL., *et al*. "Trophic transfer, transformation, and impacts of engineered nanomaterials in terrestrial environments". *Environmental Science and Technology* 48.5 (2014): 2526-2540.

5. Handford CE., *et al*. "Implications of nanotechnology for the agr-food industry: Opportunitites, benefits and risks". *Trends in Food Science and Technology* 40.2 (2014): 226-241.

6. Mukhopadhyay SS. "Nanotechnology in agriculture: Prospects and constrains". *Nanotechnology, Science and Applications* 7 (2014): 63-71.

7. Holden PA., *et al*. "Considerations of environmentally relevant test conditions for improved evaluation of ecological hazards of engineered nanomaterials". *Environmental Science and Technology* 50.12 (2016): 6124-6145.

8. Gottschalk F and Nowack B. "The release of engineered nanomaterials to the environment". *Journal of Environmental Monitoring* 13.5 (2011): 1145-1155.

9. Sekhon BS. "Nanotechnology in agri-food production: An overview". *Nanotechnology, Science and Applications* 7 (2014): 31-53.

10. Villasenor D., *et al*. "Plant materials for the synthesis of nanomaterials: Greener Sources". In: Kharissova O, Kharissov B Martinez L. [Eds.] Handbook of Ecomaterials. Spinger, Berlin (2018).


**Volume 1 Issue 1 November 2018**
**©All rights reserved by Erick R Bandala.**